MULTIMEDIA **UNIVERSITY**

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FINAL EXAMINATION

TRIMESTER 1, SESSION 2016/2017

EEL4116 – POWER STATIONS
(LE)

18 OCTOBER 2016
9:00 AM – 11:00 AM
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This Question Paper consists of three pages including the cover page with five Questions only.

2. Answer **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

Question 1

(a)
   (i)   Define load factor and capacity factor? When are they numerically equal?
                                                                      [4+1 marks]
   (ii) Discuss the significance of load factor of a power plant.   [6 marks]

(b) A power station has a load during a day as under:

Time in Hour	6	4	4	6	4
Load in MW	300	250	200	350	100

The power station is equipped with 4 generating sets of 100MW each.
   (i) Calculate the load factor and the capacity factor.   [6 marks]
   (ii) Determine the daily fuel requirement if the calorific value of the oil used is
        10,000 kcal/kg and the average heat rate of the station is 2,860 kcal/kWh.
                                                                      [3 marks]

Question 2

(a) Explain, with a neat sketch, the working principle of a coal-fired thermal power
    plant.   [13 marks]

(b) A power plant working on an ideal Rankine cycle has the following data:
   • Heat energy at the input to the pump, h_1=191.83 kJ/kg.
   • Heat energy at the input to the turbine, h_3 = 3445.3 kJ/kg.
   • Heat energy at the input to the condenser, h_4 = 2420.4 kJ/kg.
   • The work done by the pump is equivalent to 20 kJ/kg.

Calculate
   (i) the Rankine cycle efficiency and   [5 marks]
   (ii) the heat energy wasted in the condenser.   [2 marks]

Question 3

(a) State the main parts of a nuclear reactor.   [7 marks]

(b) What do you understand by cogeneration power plant? Explain its advantages.
                                                                      [8 marks]

(c) Brifly explain working principle of Back-pressure turbine and Pass-out turbine
    which are normally used in cogeneration.   [5 marks]

Question 4

(a)
   (i) Draw a Main and Transfer Bus scheme of a substation.   [4 marks]
   (ii) Explain the switching sequences in the above substation to take out the circuit
        breaker in a feeder for maintenance without any power interruption.
                                                                      [6 marks]

(b) Explain the operation of the following protective devices used in a substation.
   (i) Reclosers   [5 marks]
   (ii) Sectionalizers   [5 marks]
                                                                      Continued…

Question 5

(a) What are the general guidelines, based on which the electricity tariff system is evolved?   [5 marks]

(b) The capital cost of a coal-fired power station of 100 MW installed capacity is RM 6000 per installed kW. The interest and depreciation on the capital cost per annum is 8%. The fuel cost is RM 0.1/kWh and the overall efficiency of the power plant is 40%. If the desired cost per unit of energy generated by the plant is RM 0.35, at what capacity factor the plant should be run?   [8 marks]

(c) An industry consumes 5×10^6 kWh per year with a maximum demand of 10 MW at 0.8 pf. The electricity bill is prepared based on the following tariff rate:
    Maximum demand charges = RM 5.0 per kVA per month
    Energy charges = RM 0.35 per kWh
    (i)   Calculate the annual bill.   [4 marks]
    (ii)   Calculate the reduction in the bill for same energy consumption if the power factor is improved to unity by adding capacitors.   [3 marks]

End of Paper.